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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/075,428	02/14/2002	Richard L. Pierson JR.	01SC027US1	8755

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EXAMINER
KANG, DONGHEE

ART UNIT	PAPER NUMBER
2811	

DATE MAILED: 03/13/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/075,428	PIERSON ET AL.
	Examiner	Art Unit
	Donghee Kang	2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 February 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6, 8-15 and 17-21* is/are rejected.

7)☒ Claim(s) *7 & 16* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *2* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Information Disclosure Statement

1. Acknowledgment is made of receipt of applicant's Information Disclosure Statement (PTO-1449) field April 29, 2002.

Election/Restrictions

2. Applicant's election with traverse of Group I (Claims 1-21) in Paper No. 4 is acknowledged. However, applicant cancelled claims 22-32, non-elected invention, without argument. Thus, claims 1-21 are pending in this application.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims **1 & 4-5** are rejected under 35 U.S.C. 102(a) as being anticipated by Blayac et al. (US 2001/0015474).

Regarding claim **1**, Blayac et al. teach a heterojunction bipolar transistor (HBT), comprising (Fig. 7):

successive an InP emitter (E), an InGaAs base (B) and an InP collector (C) layers, a second InP sub-collector layer (SC'), and a thermally conductive first InGaAs

sub-collect layer (SC) between said InP collector (C) and second InP sub-collector (SC') layers (page 3).

Blayac et al. do not expressly teach the first InGaAs sub-collector (SC) layer is a contact layer. However, the first InGaAs sub-collector layer of Blayac et al. functions as "a contact layer" because it is connected to the collector contact pad (20) and also the sub-collector is sometimes referred to as collector contact in this field. Therefore, the first InGaAs sub-collector layer of Blayac et al. would meet the recited term "a contact layer".

Regarding claim **4**, Blayac et al. teach that said sub-collector layers SC, which includes first InGaAs & second InP layers, extend lateral to said collector layer (Fig.5).

Regarding claim **5**, Blayac et al. teach the HBT further comprising a contact pad (20) on said first sub-collector layer (SC) lateral to said collector layer for establishing a contact to the collector layer through the first (InGaAs) and second (InP) sub-collector layers (Fig.5 & section oo62 on page 3).

5. Claims **18-20** are rejected under 35 U.S.C. 102(b) as being anticipated by Katoh (US 5,041,882).

Regarding claim **18**, Katoh teaches a heterojunction bipolar transistor (HBT), comprising (Fig.1):

successive emitter (6&7), base (5) and collector (3&4) layers, and an InP collector contact layer (2) having an electrically insulative portion (13) which electrically isolates the HBT (Col.6, lines 13-38). The terms, collector contact layer and sub-

collector layer, are often used interchangeably in this field. Therefore, the InP collector contact layer of Katoh would meet the recited term "an InP sub-collector layer".

Regarding claim **19**, Katoh teaches said InP sub-collector layer (2) extends laterally beyond said collector layer (3), with said insulative portion (13) located lateral to said collector layer.

Regarding claim **20**, Katoh teaches that the insulative portion (13) of the sub-collector layer includes implanted ions, hydrogen ions, (Col.7, lines 28-30). Katoh does not expressly teach that the hydrogen ions are associated trapped conductors. However, this feature is inherent in Katoh's device because implanted ions, both in this invention and in Katoh, comprises hydrogen ions.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims **2-3, 9-11 & 13-14** are rejected under 35 U.S.C. 103(a) as being unpatentable over Blayac et al. in view of Gutierrez-Aitken et al. (US 6,376,867).

Regarding claims **2-3**, Blayac et al. do not teach said first InGaAs sub-collector layer having a thickness in the approximate range of 100-200 Angstroms. However, Gutierrez-Aitken et al. in Fig.5 teach an InGaAs (532) layer located between InP collector (518) and InP sub-collector (516) having a thickness below 100 Angstroms

hence to reduce thermal resistance effects (Col.3, lines 45-50). In Gutierrez-Aitken's device the InGaAs (532) is used as an etch stop layer to prevent InP sub-collector layer. The InGaAs contact layer of this invention also serves as an etch stop layer to protect the InP sub-collector (see disclosure; page 3, lines 15-18). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select the thickness of the first InGaAs sub-collector layer in a range of 100-200 Angstroms in Blayac's device, since this thin first InGaAs sub-collector layer allows for a good thermal transfer from the InP collector to the InP sub-collector, hence preventing overheating.

See also MPEP 2144.05. In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed.Cir. 1990) (The prior art taught carbon monoxide concentrations of "about 1-5%" while the claim was limited to "more than 5%." The court held that "about 1-5%" allowed for concentrations slightly above 5% thus the ranges overlapped.); In re Geisler, 116 F.3d 1465, 1469-71, 43 USPQ2d 1362, 1365-66 (Fed. Cir. 1997) (Claim reciting thickness of a protective layer as falling within a range of "50 to 100 Angstroms" considered prima facie obvious in view of prior art reference teaching that "for suitable protection, the thickness of the protective layer should be not less than about 10 nm [i.e., 100Angstroms]." The court stated that "by stating that suitable protection' is provided if the protective layer is about' 100 Angstroms thick, [the prior art reference] directly teaches the use of a thickness within [applicant's] claimed range.").

Regarding claim **9**, Blayac et al. teach a double heterojunction bipolar transistor (DHBT), comprising (Fig. 7):

an InP emitter (E), an InGaAs base (B), an InP collector (C), a second InP sub-collector (SC'), and a first InGaAs sub-collector (SC) between said collector (C) and second sub-collector (SC') which establishes, together with the sub-collector, a low resistance contact to the collector (page 5, section 0061 & 0062).

Blayac et al. do not expressly teach the first InGaAs sub-collector (SC) is a contact layer. However, the InGaAs sub-collector of Blayac functions as a contact layer because it is connected to collector electrode (20) and the sub-collector is sometimes referred to as collector contact in this field. Therefore, the first InGaAs sub-collector layer would meet the recited term "contact layer".

Blayac et al. do not expressly teach said first sub-collector layer (SC) being thin enough to provide a substantially higher thermally conduction path between said collector and second sub-collector than would bulk InGaAs. However, Gutierrez-Aitken et al. teach that if the InGaAs layer (532) located between collector and sub-collector is kept to a thickness below 100 Å, the effect of this layer (532) on thermal resistance of the device will be minimal (Fig.5 & Col.3, lines 45-50). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the first InGaAs sub-collector layer being thin enough in Blayac's device in order to minimize thermal resistance of the device.

Regarding claims **10-11**, Blayac et al. do not expressly teach said first InGaAs sub-collector layer (SC) having a thickness in the approximate range of 100-200

Angstroms hence to allow for a good thermal transfer from the InP collector to the second InP sub-collector.

However, Gutierrez-Aitken et al. in Fig.5 teach an InGaAs (532) layer located between InP collector (518) and InP sub-collector (516) having a thickness below 100 Angstroms hence to reduce thermal resistance effects (Col.3, lines 45-50). In Gutierrez-Aitken's device the InGaAs (532) is used as an etch stop layer to prevent InP sub-collector layer. The InGaAs contact layer of this invention also serves as an etch stop layer to protect the InP sub-collector (see disclosure; page 3, lines 15-18). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select the thickness of first InGaAs sub-collector layer in a range of 100-200 Angstroms in Blayac's device, since this thin first InGaAs sub-collector layer allows for a good thermal transfer from the InP collector to the InP sub-collector, hence preventing overheating.

Regarding claim **13**, Blayac et al. teach said sub-collector layers SC (InGaAs & InP) extending lateral to said collector (Fig.5 & section 0033 & 0035 on page 2).

Regarding claim **14**, Blayac et al. teach the DHBT further comprising a contact pad (20) on said first sub-collector layer SC lateral to said collector (Fig.5).

8. Claims **6, 8, 15, &17** are rejected under 35 U.S.C. 103(a) as being unpatentable over Blayac et al. (US 2001/0015474) in view of Katoh (US 5,041,882).

Regarding claim **6**, Blayac et al. teach said sub-collector layers includes a functional portion aligned with said collector layer. Blayac et al. do not teach an

electrically insulating portion lateral to said collector layer and outside the area of said functional sub-collector portion to electrically isolates said HBT. Katoh in Fig.1 teaches an electrically insulating portion (13) lateral to said collector layer (3) and outside the area of said functional sub-collector portion to electrically isolates said HBT. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the isolation region of Katoh into the Blayac's device in order to isolate the HBT from other elements.

Regarding claims **8 & 17**, Blayac et al. do not teach said insulating portion of the sub-collector layer including implanted ions and associated trapped conductors. Katoh teaches that the insulative portion (13) of the sub-collector layer includes implanted ions, hydrogen ions, (Col.7, lines 28-30). Katoh does not expressly teach that the hydrogen ions are associated trapped conductors. However, this feature is inherent in Katoh's device because implanted ions, both in this invention and in Katoh, comprises hydrogen ions.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the insulating portion using ion implantation, since the ion implantation has a several advantages, such as ability to more precisely control the number of implanted dopant atoms into substrate.

Regarding claim **15**, Blayac et al. do not teach at least a portion of said sub-collector layers lateral to said collector is electrically insulating to electrically isolate said HBT. Katoh teaches at least a portion (13) of said sub-collector lateral (2) to said collector (3) is electrically insulating to electrically isolate said HBT. Therefore, it would

have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the isolation region of Katoh into the Blayac's device in order to isolate the HBT from other elements.

9. Claim **12** is rejected under 35 U.S.C. 103(a) as being unpatentable over Blayac et al. (US 2001/0015474) in view of Gutierrez-Aitken et al. (US 6,376,867) and further in view of Katoh (US 5,041,882).

Neither Blayac et al. nor Gutierrez-Aitken et al. teach the sub-collector (collector contact) layer in doped N+. Katoh in Fig.1 teaches an n-type heterojunction bipolar transistor including a heavily doped (n+) collector contact layer (2). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select a conductivity type in order to form a desired device having an appropriate conductivity type. It would have been obvious to one of ordinary skill in the art at the time the invention was made to form heavily doped collector contact in Blayac's device in order to enhance a conductivity of contact layer, hence to improve charges collecting.

10. Claim **21** is rejected under 35 U.S.C. 103(a) as being unpatentable over Katoh (US 5,041,882) in view of Lammert (US 6,406,965).

Katoh does not teach ion having a more uniform than gaussian distribution through the thickness of said sub-collector layer. Lammert in Fig.18 teaches creating implant areas (52) in the sub-collector (12) using multiple doses and energies of implanted species as necessary to create uniform damage through this region (Col.4,

lines 60-66). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form uniform insulating region in Katoh's device, since this uniform implant areas can provide better the electrical isolation region between electrical elements in integrated circuits.

Allowable Subject Matter

11. Claims **7 & 16** are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: Prior art references, taken along or in combination, do not teach or render obvious that the first sub-collector layer extends laterally beyond the second sub-collector layer and the insulating portion of the first sub-collector layer is lateral to said second sub-collector layer.

Conclusion

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Donghee Kang whose telephone number is 703-305-9147. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Donghee Kang

Donghee Kang
Patent Examiner

dhk
March 10, 2003